Educational Homogamy and Inter-Couple Income Inequality: Linking Demographic and Socio-Economic Consequences of Educational Expansion in Germany and Switzerland

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Educational Homogamy and Inter-Couple Income Inequality: Linking Demographic and Socio-Economic Consequences of Educational Expansion in Germany and Switzerland

Ramsey Wise* and Christoph Zangger**

Abstract: How is educational expansion associated with increased educational homogamy and income inequality? Using SOEP and SHP panel data, we randomly match couples and compare the resulting income distribution to the observed one. Educational homogamy thereby has had only a marginal impact on earnings-based income inequality between couples, which is largely due to the endogenous decision-making of couples concerning working time.

Keywords: educational homogamy, educational expansion, income inequality, labor supply

Bildungshomogamie und Einkommensungleichheit zwischen Paarhaushalten: Demographische und sozioökonomische Konsequenzen der Bildungsexpansion in Deutschland und der Schweiz

Zusammenfassung: Inwiefern geht die Bildungsexpansion mit erhöhter Bildungshomogamie und Einkommensungleichheit einher? Mittels Paneldaten des SOEP und des SHP vergleichen wir die Einkommensungleichheit zufällig erstellter Paarhaushalte mit der beobachteten Verteilung. Die Bildungshomogamie hatte dabei jedoch nur einen marginalen Einfluss auf die Einkommensungleichheit zwischen Paarhaushalten und ist weitgehend auf deren endogene Erwerbsentscheidungen zurückführbar.

Schlüsselwörter: Bildungshomogamie, Bildungsexpansion, Einkommensungleichheit, Arbeitskräfteangebot

Homogamie éducative et inégalité des revenus entre couples : Les conséquences démographiques et socio-économique de l'expansion du système de formation en Allemagne et en Suisse

Résumé : Est-ce que l'expansion du système de formation s'accompagne d'une augmentation de l'homogamie éducative et de l'inégalité des revenus? Par recours aux données des panels SOEP et PSM, nous comparons la distribution des revenus de couples choisis aléatoirement avec la distribution observée. L' homohamie éducative n'a toutefois qu'un effet marginal sur l'inégalité des revenus entre les couples, reflétant la décision endogène des couples concernant leurs heures travaillées.

Mots-clés : homogamie éducative , expansion du système de formation , inégalité des revenus , offre du travail

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1 Introduction

Women have particularly benefited from educational expansion in most European countries, including Germany and Switzerland (Becker and Zangger 2013; Breen et al. 2010; Hadjar and Becker 2009). The ensuing increase in female human capital has further translated into higher employment rates of women in these countries (Blossfeld and Hakim 1997; Blossfeld and Hofmeister 2006; van der Lippe and van Dijk 2002). Although these trends positively signal the weakening of gender inequalities in some areas, they may also contribute to socio-economic inequalities in others, especially if these trends have strengthened educational homogamy, or the increased similarity between the human capital resources of couples. More precisely, we aim to evaluate whether changes in the level of educational homogamy, in the course of educational expansion, corresponds with rising inter-couple income inequality across birth cohorts.

Although the relationship between educational expansion and educational homogamy is extensively discussed in the literature (e. g., Blossfeld and Timm 2003; Harkness 2013; Schwartz 2013), few studies have linked these socio-demographic trends to rising income inequality in recent years. Most studies interested in socio-demographic explanations have attributed rising income inequality to changes in household structure, specifically with references to the increase of single households (e. g., Esping-Andersen 2007; Kollmeyer 2013; Western et al. 2008). Only a few studies have empirically tested whether there is a relationship between educational homogamy and rising income inequality (for examples, see Breen and Salazar 2011; Schwartz 2010; Cancian and Reed 1999; Breen and Salazar 2010; Breen and Andersen 2012; Dribe and Nystedt 2013; Pestel 2015; Spitzenpfeil and Andress 2014). The vast majority of these studies, however, have only focused on countries that are typically characterized as dual-earner countries (i. e. Anglo-Saxon or Scandinavian countries, see Spitzenpfeil and Andress 2014).

While most studies on educational expansion have by far focused only on *either* socio-demographic or socio-economic consequences, we link the two interrelated concepts to identify whether increased female human capital and educational homogamy are associated with rising income inequality in Germany and Switzerland. To our knowledge, this is the first comparative study to empirically test the relationship between homogamy and inter-couple income inequality. We selected Germany and Switzerland as they are traditionally considered as ideal male breadwinner countries (Pfau-Effinger 2012) with a strong emphasis on vocational training (Crouch et al. 2001). In addition, many of the macro-economic explanations for rising income inequalities, such as increased unemployment, are expected to have little effect on income inequality in these countries as demonstrated by comparatively low and stable unemployment levels in recent years (Grabka and

Kuhn 2012). Consequently, we are able to focus on socio-demographic changes contributing to inter-couple income inequality.

To understand the relationship between educational expansion, educational homogamy and inter-couple income inequality, we ask whether the growing source of female human capital has influenced individual partner preferences. For individuals who select into partnership, we ask whether partner preferences have strengthened educational homogamy over time. To this end, we first assess whether the association of partners' human capital endowments has amplified across birth cohorts (Blossfeld and Timm 2003; Kalmijn 1998; Mare 1991; Schwartz and Mare 2005; Breen and Salazar 2010).

In a second step, we assess whether educational homogamy has impacted inter-couple income inequality dynamics. To this end, we randomly match individuals in the sample so as to construct relevant counterfactuals to the observed couples. If observed couples select partners based on similar educational endowments (i. e. educational homogamy), then the randomly matched couples remove the effect of partnering choices. In principle, this analytical strategy allows for us to assess the effect of educational homogamy on inter-couple income inequality by comparing the levels of inequality using Gini coefficients for the observed couples with that of the randomly matched couples.

At the same time, annual income reflects both earnings capacity and labor supply (Pestel 2015). As demonstrated in previous studies, intra-couple behavioral decisions concerning employment are closely tied to partners' educational and economic resources (Drobnič and Blossfeld 2004; Peichl et al. 2012; Kollmeyer 2013). Especially for traditionally male breadwinner countries, we expect that partnering choices are extremely likely to further influence female labor supply. Hence, randomly matching couples is not alone sufficient because the labor supply of partners in a household is endogenous. To this end, we thirdly assess whether the difference in levels of inequality would be greater between the observed and randomly matched couples after adjusting labor supply to what it would be if couples were randomly matched. By doing so, we are able to isolate the independent effect of educational homogamy on income inequality across birth cohorts (Aslaksen et al. 2005).

Furthermore, we expect that labor supply could potentially offset or reinforce the effect of educational homogamy on income inequality. For example, educational homogamy is only assumed to increase if highly educated couples, and conversely low educated couples, are matched accordingly and both partners fully utilize their human capital. If so, female labor supply can be viewed as reinforcing income inequality between correspondingly high and low earnings couples. However, if highly educated women rely on the earnings potential of their husband and reduce their labor supply, this is extremely likely to offset the effect of educational homogamy. By investigating these interrelated dynamics, the results of this study pose profound

implications for concerning the unforeseen consequences of educational expansion with regards to a potential trade-off between gender inequality and income inequality.

The following sections are outlined as follows. In Section 2, we present theoretical considerations concerning marital markets and behavioral choices concerning female labor supply in order to derive hypotheses about potential consequences for inter-couple income inequality. In Section 3, we discuss operationalization and comparability of the data used for our analyses, and we provide an overview of our methodological approach. In Section 4, we present descriptive results comparing educational and employment participation for each country across birth cohorts. We then compare educational homogamy with inter-couple income inequality trends, highlighting differences between the observed sample, our randomly matched sample and a simulated sample where we also adjust for labor supply. Section 5 discusses socio-economic implications of these results for both countries.

2 Theoretical considerations

Our premise is that educational expansion has altered the distribution of human capital, especially among women. To what extent this trend is associated with changes in partner preferences is the first question that this study aims to answer. To this end, we firstly turn to theories concerning the relationship between partner preferences and educational homogamy in the course of educational expansion. Secondly, we provide hypotheses concerning the expected relationship between educational homogamy and income inequality, with further discussion of gender differences regarding labor supply of couples.

2.1 Educational expansion and partner preferences

Numerous studies have shown that individuals do not marry at random. On the contrary, partner selection is based on individual preferences, which are largely influenced by socialization processes and overlapping social networks (Blossfeld and Timm 2003; Kalmijn 1998; Mare 1991; Waldfogel 1997). Educational homogamy reflects these preferences, as individuals tend to favor partners with a similar educational background and economic resources (Blossfeld and Drobnič 2001; Blossfeld and Timm 2003; Kalmijn 1998; Mare 1991; Schwartz and Mare 2005). Socialization processes occurring within post-secondary educational institution settings are one explanation for homogenous preferences. As Mare (1991) notes, the prolongation of education increases the opportunities to mate with someone of a similar educational level.

Furthermore, marital matching theories build upon this assumption, arguing that prolonged educational settings improve marriage market opportunities (Becker 1981). First, prolonged educational settings provide greater opportunities to find a

partner. Second, socialization within this setting increases the likelihood for preferring a partner with similar educational and socio-economic resources. Finally, the gained human capital from this setting is extremely likely to optimally positioned highly educated individuals within the distribution of partner candidates (Lewis and Oppenheimer 2000; Lichter et al. 1995).

This perspective has two implications that are central to our research. If women select partners of similar educational background, we firstly hypothesize that educational homogamy is strengthened across birth cohorts as consequence of increasing female human capital (H1a). As women have particularly gained from educational expansion in recent decades, we secondly hypothesize that any changes related to educational homogamy are primarily driven by a decrease in women marrying upwards, and conversely, a decrease in men marrying downwards (H1b).

2.2 Educational homogamy and inter-couple income inequality

Although previous studies attribute much of rising income inequality between households to the increase of single households (Esping-Andersen 2007; Kollmeyer 2013; Western et al. 2008), our study focuses solely on the income inequality between couples. More precisely, we are primarily interested in whether educational homogamy increases differences in the income distribution between couples. As educational homogamy reduces the level of intra-couple income redistribution, inter-couple income inequality is increased (Aslaksen et al. 2005; Schwartz 2010).

To test this assumption, we compare the Gini coefficients of observed couples with randomly matched couples. If observed couples select partners based on similar educational endowments (i. e. educational homogamy), then the randomly matched couples remove the effect of partnering choices. Thus, we hypothesize that the observed inter-couple income inequality is higher than if couples were partnered randomly (H2a).

Against the backdrop of educational expansion, we further expect the effect of educational homogamy on income inequality to amplify across birth cohorts. As women increase their human capital at an aggregate level, the association between partners' educational endowments should strengthen. Moreover, this is extremely likely to correspond with increasing differences in household incomes of high and low earnings couples. Hence, we hypothesize that inter-couple income inequality is increasingly higher for younger birth cohorts, as a reflection of increased homogamy following educational expansion (H2b)

As income is a reflection of both earnings potential and labor supply, this perspective is partially based on the assumption that individuals optimally utilize their human capital resources on the labor market (Becker 1964). However, individual decisions concerning employment and work time are directly linked to family strategies to maximize household utility (Becker 1981). From life course research, Elder (1994) coined the term "linked lives" to describe complex interrelationships

across work and family domains. If both individuals in the household do not intend to maximize their labor force utility, then there is no reason to expect educational homogamy to be associated with a high correlation in earnings between partners (Breen et al. 2010; Breen and Salazar 2011; Schwartz 2013).

For Germany and Switzerland, female employment patterns are largely dependent on household composition and partners' earnings, regardless of the individual earnings potential derived from human capital (Blossfeld and Drobnič 2001; Drobnič and Blossfeld 2004; Kollmeyer 2013). As male breadwinner countries, these countries exhibit lower employment rates of women than for men, with a large share of married women employed only part-time (Gottschalk and Danziger 2005; Gottschalk and Smeeding 1997; Harkness 2013; Juhn and Murphy 1997). Because female labor supply has been shown in these countries as reduced proportionally to partners' earnings (Kollmeyer 2013), we expect gender differences with regards to time allocation for domestic work and paid labor to weaken the observed effect of educational homogamy on inter-couple income inequality.

Following Pestel (2015), we first account for differences in (female) labor supply across households in order to assess the effect of educational homogamy on inter-couple income inequality. Given the expected association of partners' income on labor supply in male breadwinner countries, we hypothesize that the observed labor supply weakens the total effect of educational homogamy on inter-couple income inequality (H3). If this is correct, a trade-off between the utilization of female human capital independent of partners' earnings is extremely likely to increase income inequality.

2.3 Case selection and hypothesized differences

The case selection of Germany and Switzerland for our analysis allows us to conduct a similar systems comparative approach, as these countries demonstrate relatively similar socio-demographic and macro-economic trends for the years observed (Grabka and Kuhn 2012). More precisely, both countries are typically modeled as traditional male breadwinner countries, although this aspect has weakened in recent years as women have increased their human capital, and subsequently, their labor supply (Blossfeld and Hakim 1997; van der Lippe and van Dijk 2001).

With respect to educational expansion, perhaps the most striking trend is female participation in higher education. With roughly a quarter of women in Germany and a third of women in Switzerland holding a tertiary degree, the once persistent gender gap in higher education has become virtually eliminated for younger cohorts (see Appendix 4). Interestingly, vocational participation rates have been relatively high and stable in both countries, especially as credentials necessary to enter female-typical occupations (e. g., nursing or social services) are received at vocational schools (Haasler and Gottschall 2015; Smyth and Steinmetz 2008).

With regards to labor force participation, both countries demonstrate an increase in employment rates, although rates are slightly higher in Switzerland than in Germany (see Appendix 4). For women who are employed, part-time employment rates are particularly pronounced in Germany, where women holding a part-time position are often considered as supplementary earners (Daly and Scheiwe 2010; Levy et al. 2007; Giesselmann and Lohmann 2008).

Despite increases in both female human capital and labor force participation for these countries, gender differences still persist, especially with regards to work-time and pay (Keck and Saraceno 2013; Mandel and Semyonov 2005). Due to socio-structural similarities between these countries, we expect our hypotheses to apply to both countries. Because of these additional differences in the levels of female labor force participation between countries, however, we hypothesize that the effect of educational homogamy on inter-couple income inequality to be more pronounced in Switzerland than in Germany (H4).

3 Data and methods

In this paper, we analyze demographic and socio-economic consequences of educational expansion in Germany and Switzerland using longitudinal data provided by the German Socio-Economic Panel (SOEP) and the Swiss Household Panel (SHP).[1] More expressly, we estimate the effect of educational homogamy on inter-couple income inequality across birth cohorts by constructing counterfactual couples via random matching (see Hryshko et al. 2015). To this end, we restrict our data to the working age population with a slightly higher lower age cut-off in order to account for individuals still in education (i. e. ages 25–65).

The two data sources offer the advantage of not only including rich information about the employment status, working hours and economic resources of individuals and their partners, but also regarding relevant demographic variables such as age, gender and education. In this analysis, the latter variable is defined by three categories: general schooling, vocational education and higher education. Additionally, tenure, the number of children and migration background were used as controls in further analyses. A complete list of variables and their operationalization for comparability is provided in Appendix 1, with summary statistics of variables provided for both data sets in Appendix 2 and 3.

As we are primarily interested in describing to what extent income inequality has increased in response to increased educational homogamy, we address three

1 Since the two panels differ with regard to the covered time period, we construct a pooled dataset including all waves from 1999 to 2013 for both panels in order to make the analyses comparable. However, this pooling also implies that all analyses using data across years need to account for multiple observations of the same individual. This is done in the present context by using cluster robust standard errors.

methodological issues related to 1) the structural effects of educational expansion, 2) the comparison of observed couples with counterfactual ones had couples been randomly matched and 3) the endogenous nature of labor supply within households. How we have addressed these issues in our study is discussed in the following sections, with a final section detailing our analytical strategy for comparing Gini Coefficients to estimate the effect of educational homogamy on income inequality.

3.1 Structural effects of educational expansion

First, birth cohorts are conceived here as denoting temporal units of educational expansion in Germany and Switzerland. By comparing the effects of educational homogamy on inter-couple income inequality across birth cohorts, we are able to identify structural effects of educational expansion. Regarding educational homogamy, the notion of the educational system as a marriage market also suggests that spouses belonging to the same birth cohort are likely to have experienced the same context in terms of the educational expansion (Mare 1991).

The differentiation of the analysis with regard to birth cohorts is therefore a necessary step to address the structural effect of the educational expansion on the development of earning inequalities via educational homogamy. Moreover, this approach complements previous research that focuses only on recent period changes rather than cohort changes (e. g., Pestel 2015 for the case of Germany). An obvious weakness of this design, however, is that birth cohorts are observed at different stages in the life course during the years surveyed. Thus, old cohorts are at later stages, whereas younger cohorts are at earlier stages. In the literature, this is referred to as an identification problem of age, period and cohort effects (see Bell and Jones 2014; Fienberg and Mason 1979; Glenn 1976). Given the restricted time-span of our data, however, it is not possible to disentangle differences observed across cohorts from age effects.

3.2 Educational homogamy and random matching procedure

Our second methodological issue relates to how we assess the effect of educational homogamy on inter-couple income inequality. To this end, we randomly match couples in the data in order to construct relevant counterfactuals to the observed couples. If observed couples select partners based on similar educational endowments (i. e. educational homogamy), then the randomly matched couples remove the effect of partnering choices. To assess to what extent educational homogamy contributes to inter-couple income inequality, we plot Gini Coefficients using the Lorenz command in Stata for each birth cohort (see Jann 2016).

Because we are further interested in changes in the effects of educational homogamy across cohorts as a reflection of educational expansion, we compare these differences across birth cohorts to assess how the association between couple formation and the development of income inequalities may have changed in the

two countries. This also implies that we need to condition our random matching of couples on individual cohort membership. To this end, we randomly matched couples belonging to the same birth cohort. Note that this conditional matching – although appropriate given the theoretical background – leads to problematic matches at the borders of the sample space of each cohort. In such a setting, for example, a man born in 1979 might not be matched to a woman born in 1980 if they belong to two different cohorts. In order to deal with this rather strict assumption, the matching takes place as a sampling without replacement. In the present context, this is obtained by sorting the data according to year of observation, birth cohort and gender, as well as an additional random variable.

To this end, a file containing information about partners is prepared in the same way, whereby the sorting with regard to gender is reversed. The two datasets are then merged line-by-line, generating random couples. In doing so, we maintain the observed association of couples' cohort membership while removing the association of their educational endowments (see Table 1) as well as in all further characteristics. Thus, only people observed in the same survey year are matched to each other.

3.3 Accounting for endogenous labor supply

To address our third empirical issue, we account for the endogenous nature of labor supply within households by using a structural model of labor supply (Creedy and Kalb 2005; Pestel 2015). To this end, we consider employment status, hours worked and earnings accumulated not only as a function of an individual's characteristics (e. g., education, age, sex, etc.), but also of a couple's coordination – or bargaining process – that is based also on the characteristics of one's partner.

Assuming that households seek to maximize their utility U_i, this negotiation process can be thought of as the maximization of the potential earnings of randomly matched spouses given their individual and household characteristics and especially the counterfactual hours of leisure $h_{i,k,f}$ and $h_{i,k,m}$ as the complement to the hours worked (where the index *f* and *m* designate female and male, respectively). Following the literature on the estimation of labor supply models (Creedy and Kalb 2005; Pestel 2015), we model the utility of the j^{th} working time combination (out of 7×7 combinations – see Appendix A1) for household *i* as

$$\begin{aligned} U_{i,j} = {} & \beta_1 \ln(income_{j;m,f}) + \beta_2 \ln(leisure_{j;f}) + \beta_3 \ln(leisure_{j;m}) \\ & + \beta_4 \ln(leisure_{j;f}) * \ln(leisure_{j;m}) + \beta_5 \ln(leisure_{j;f}) * \ln(income_{j;m}) \\ & + \beta_6 \ln(leisure_m) * \ln(income_{j;f}) + \varepsilon_{i,j} \qquad j = 1, \ldots, 49 \end{aligned}$$

and additional higher order terms of leisure and income as well as interactions of leisure with own and partner's education and age as well as with the number of children of different ages, cohort and migration background. Thus, the household utility function used in the present study follows a joint translog function (i. e. tak-

ing the logarithm of all individual and household characteristics), with the main arguments income and leisure included in the model along with further individual and household characteristics (Creedy and Kalb 2005; Pestel 2015). While the model was estimated as a conditional logit model, the predicted utility function of observed couples is then used to predict counterfactual couples' labor supply (i. e. households constructed via random matching).

However, in order to make these counterfactual predictions, we have to impute the hypothetical income for all individuals not working. To this end, we first estimate the log-transformed hourly wage rate for all employed people as well as those not in the labor force or who are currently unemployed for each year separately using a Heckman selection model (Heckman 1979). Given the purpose of the present study, the estimation of the wage rate and the individual gross annual income is a necessary step in order to adequately model couples' decisions about their joint labor supply.

Whereas wage rates were predicted by individual human capital assets (e. g., education, tenure, etc.) and contextual differences in wage rates (e. g., gender, age, migration background, and region), the selection mechanisms influencing female labor supply were mainly constructed by individual characteristics and household formation variables (e. g., family status, number of children and the interaction of these variables with gender). More formally, the logarithm of the wage rate was predicted as

$$E\left[\ln(y) \mid z^* > 0; year\right] = \beta_1 education + \beta_2 tenure + \beta_3 tenure^2 + \beta_4 age + \beta_5 age^2 + \beta_6 class + \beta_7 gender + \beta_8 migration + \beta_9 region + \beta_{10} cohort$$

and the selection into paid employment as

$$E\left[z^* \mid year\right] = y_1 edu + y_2 gender + y_3 migration + y_4 region + y_5 age + y_6 age^2 + y_7 cohort + y_8 civil\ status + y_9 kids1 + y_{10} kids2 + y_{11} kids3 + y_{12} gender * kids1 + y_{13} gender * kids2 + y_{14} gender * kids3$$

In order to take the uncertainty of this imputation in latter analyses into account, we added a random draw of the error distribution to the predicted wage rate of each observation. This then served as the basis for constructing the predicted gross household income based solely on couple's earnings for all dual households in the sample and for all of the 49 working time combinations they can choose from.[2]

2 Although the reported inequality is comparable to the one in other studies using the same data (Grabka and Kuhn 2012), the inequality measure based on the predicted working income slightly underestimates the actual one in the observed data.

3.4 Analytical strategy for comparing income inequality measures

These predictions are then used for calculating the counterfactual couples' earnings distribution in order to assess the impact of educational homogamy on income inequality between couples and across cohorts using Gini coefficients. Further discussion of results from our study is done so with the understanding that we focus only on inter-couple income inequality, which contributes only partially to the overall household income inequality. To this end, we calculate three Gini coefficients for each birth cohort.

The first measure estimates the overall income inequality of the observed couples in the data (A). The second measure calculates the income inequality of randomly matched couples, after adjusting for labor supply (B). This measure simulates what the level of inequality would be if partners were matched at random and their labor supply adjusted to their hypothetical partner's earning potential. Consequently, the difference between A and B reflects the total effect of educational homogamy. However, the confounding effect of labor supply remains, as we cannot ascertain how much of this difference is attributed to educational homogamy alone or due to the endogenous labor supply behavior of couples.

To this end, we calculate a third, counterfactual measure of income inequality for the observed couples in which their actual partners were to work the hours of the randomly matched ones (C). By comparing A and C, we are then able to derive the total effect of labor supply on income inequality, i. e. the extent to which income inequality would decrease if labor supply decisions were not endogenous to the household context.

Our primary interest, however, lies in the difference between B and C. By comparing differences in inequality of randomly matched couples and observed couples after adjusting for the labor supply of both, we are able to derive the pure effect of educational homogamy on inter-couple income inequality. Compared to a naïve estimation of educational homogamy effects between measures A and C, this difference excludes the offsetting effect of labor supply on income inequality.

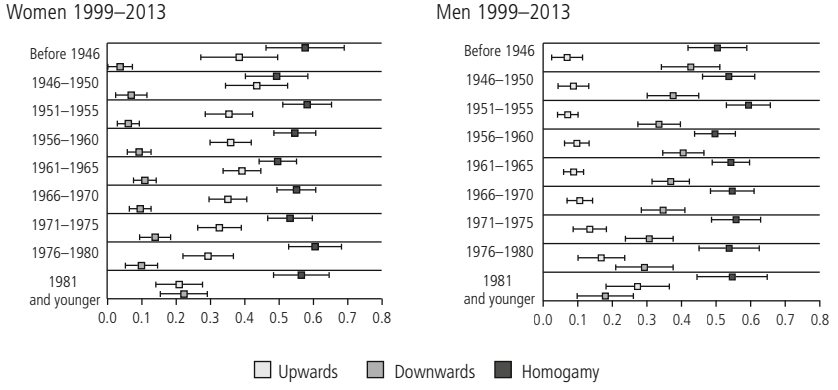
4 Results

As discussed in the previous section, we estimate the effect of educational homogamy using a counterfactual approach. To this end, our first step is to assess the level of educational homogamy across birth cohorts. This allows us to observe whether there is indeed an increase in educational homogamy in the aftermath of educational expansion. Secondly, we assess to what extent educational homogamy has contributed to inter-couple income inequality across birth cohorts by comparing the Gini coefficients of the three measures discussed in the analytical strategy section.

4.1 Results from the random matching of couples

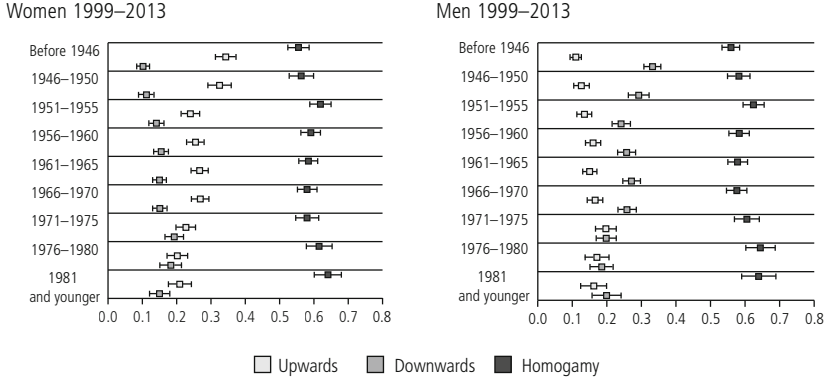
To assess the extent of educational homogamy across birth cohorts, Figures 1 and 2 show the share of couples in the observed data that are matched according to the same level of educational endowments. In both countries, we find educational homogamy to be strong and stable over time, with roughly 60% of couples in the sample partnered with similar educational qualifications. Therefore, we are unable to confirm our first hypothesis of an increase in educational homogamy for Germany and Switzerland (H1a).

Figure 1 Observed educational homogamy in Switzerland



Source: Swiss Household Panel (w15), 1999–2013.

Figure 2 Observed educational homogamy in Germany



Source: German Socio Economic Panel (w30), 1999–2013.

Although we do not find support for a clear increase in educational homogamy as hypothesized, this initial finding is nonetheless consistent with previous studies on educational homogamy trends in recent decades (Blossfeld and Timm 2003; Breen and Salazar 2010; Breen and Salazar 2011; Breen and Andersen 2012). Upon further investigation of gender differences in partner patterns, we find that highly educated women are more likely to be single than men, which could counteract the hypothesized increase in educational homogamy.

Nevertheless, we do see a convergence of male and female patterns across cohorts. Whereas older male cohorts were more likely to marry downwards and older female cohorts marry upwards, there is no gender difference amongst the younger cohorts (i. e. for individuals born after 1971). Thus, we do find supporting evidence for the convergence of the shares for upward and downward marrying couples amongst later cohorts (H1b).

Turning to the assessment of the consequences of educational expansion and educational inequality on the development of inter-couple income inequality, we first turn our attention to the constructed counterfactual couples. As shown in Table 1, our matching approach seems to be quite successful in reproducing the intended structure (i. e. in terms of age and cohort membership). In addition, the randomly matched data successfully eliminates the correlation between couples with regard to educational endowments, the hourly wage rate and the hours worked. Interestingly, we find little similarity between the log-transformed hourly wage rates of couples. This is likely explained by the low participation rate of women in traditionally male-breadwinner countries. Thus, the small association between couples' hours worked likely indicates that couples typically have one primary earner.

Table 1 Partial correlations before and after random matching

	SHP		SOEP	
	Observed	Randomly matched	Observed	Randomly matched
Age	0.885	0.923	0.909	0.937
Cohort	0.864	0.945	0.889	0.960
Highest education	0.268	–0.005	0.388	0.003
ln(hourly wage rate)	0.067	–0.002	0.075	0.002
Hours worked	–0.040	–0.009	0.086	0.022
N	24 648	24 648	134 720	134 720

Sources: German Socio Economic Panel (w30), 1999–2013; Swiss Household Panel, 1999–2013; own calculations, controlling for year of observation and cohort.

4.2 Income inequality of observed and randomly matched couples

In order to better understand the potential effects of educational homogamy on income inequality, we compare the distribution of inequality between observed couples and randomly matched couples according to their educational endowments

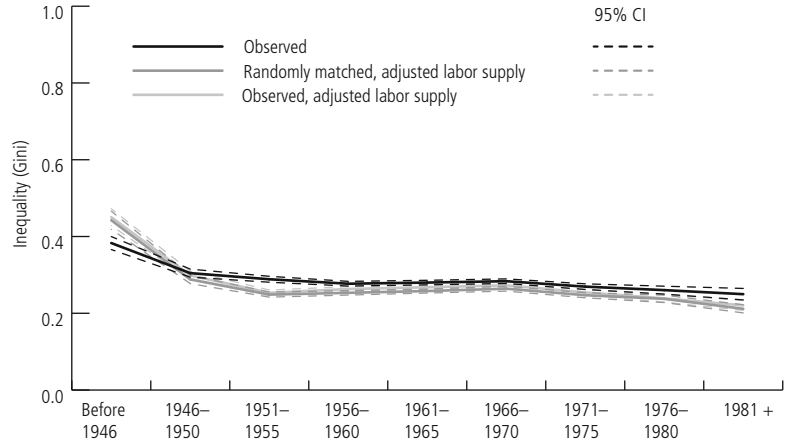
across cohorts. Following the arguments in the theoretical section, we further take into consideration to what extent households' labor supply decisions contribute to differences in this distribution. To this end, we not only compare the observed income inequality (A) to the randomly matched couples after adjusting for labor supply (B), but also construct a counterfactual for observed couples in which their partners work the hours of those under random matching (C).

By adjusting for labor supply for both observed and randomly matched couples, we are able to derive the pure effect of educational homogamy (i. e. between the observed and counterfactual inter-couple income inequality after adjusting for labor supply for both groups if they were randomly paired). In addition, the comparison of observed couples (A) with observed couples with adjusted for labor supply (C) provides us with the effect of labor supply on inter-couple income inequality. The distance between these distributions demonstrate the size of the effect, while lower scores of the randomly matched data suggests that these two effects do indeed contribute to inter-couple income inequality.

Figures 3 and 4 demonstrate differences in the distribution of inequality for A) the observed couples (i. e. black lines), B) randomly matched couples with adjusted labor supply (i. e. grey lines) and C) our counterfactual couples (i. e. light grey lines). More precisely, a lower Gini coefficient of the randomly matched couples suggests that educational homogamy and (female) labor supply both contribute to income inequality in these countries. To isolate these effects, the counterfactual couples also take into account the household strategies to maximize household utility in terms of labor supply decisions (Becker 1981; Elder 1994). To estimate the pure effect of educational homogamy on income inequality across cohorts, we compare the observed inequality to its counterfactual (i. e. the distribution of inequality of observed couples if they were to work the hours of randomly matched partners).

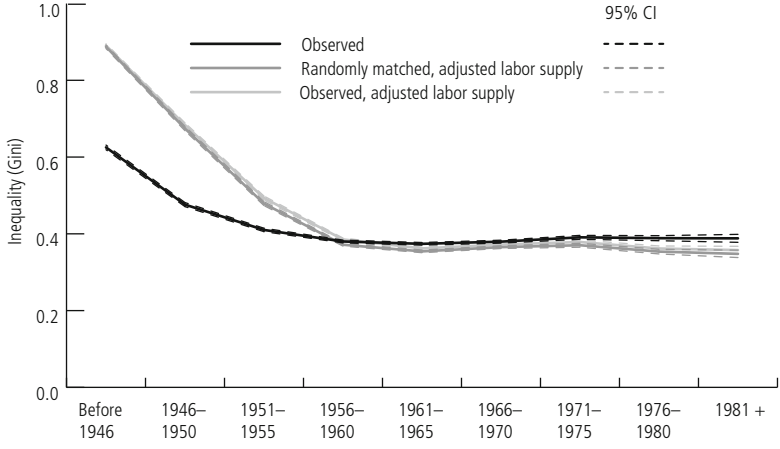
While the observed inequality is generally higher and more stable for younger cohorts in Germany than in Switzerland, the distribution of the different measures reveals a similar pattern in both countries. For Switzerland as well as for Germany, inequality of randomly matched couples is generally lower than the observed one (see Figure 3 and 4, black vs. grey lines). Thus, we find support for H2a in both countries, although differences are not always statistically significant. Moreover, we find that differences are strongest for older cohorts in both Switzerland and Germany where, however, inequality is predicted to be even higher under a random allocation of partners and the corresponding labor supply decisions. For the case of Germany, there is additionally some indication of an increase in this difference for younger cohorts (widening gap between the black and the grey line in Figure 4 for the two youngest cohorts (H2b). Against the background of a stable level of homogamy in both countries, the opposite effects for younger and older cohorts might suggest differences in labor supply behavior across cohorts. However, we find no clear support for our hypothesis that effects are stronger in Switzerland than in

Figure 3 Gini coefficients after matching in Switzerland



Source: Swiss Household Panel (w15), 1999–2013.

Figure 4 Gini coefficients after matching in Germany



Source: German Socio Economic Panel (w30), 1999–2013.

Germany (H4), despite differences between these countries concerning endogenous decision-making of household regarding labor supply (see Appendix 4).

In addition, these findings further suggest that the effect of educational homogamy on income inequality is largely mediated through couples' labor supply decisions. This can be observed by the difference in the Gini coefficients of observed couples (A) and the counterfactual couples with adjusted labor supply (C). As the

total effect of a non-random choice of partners is mostly mediated by endogenous labor supply decisions, we find support for our hypothesis that labor supply offsets the effect of educational homogamy on inter-couple income inequality (H3). Furthermore, there is no solid indication that these effects change across cohorts, as all three measures are nearly parallel for birth cohorts after 1950. Thus, in line with the above outlined stable level of educational homogamy, educational expansion did not seem to have amplified the effects of educational homogamy and couples' labor supply decisions on inter-couple income inequality.

5 Discussion

Our study addresses potential consequences of educational expansion as a reflection of interrelated socio-demographic and socio-economic trends. More precisely, we assess the impact of educational homogamy on inter-couple income inequality, against the background of educational expansion. In order to understand the relationship between these trends and inter-couple income inequality, we have addressed several empirical issues. First, we conceptualized a structural definition of birth cohorts as temporal units of educational expansion. Second, we compared the Gini coefficients of observed and randomly matched couples. Third, we addressed the endogenous nature of labor supply within households.

To this end, we have selected two countries that not only demonstrate similar demographic and economic trends contributing to income inequality in recent years, but also are characterized by a strong male breadwinner model. Using the Swiss Household Panel and German Socio-Economic Panel, our analyses confirm much of what has been shown in related studies. This includes a substantial increase in female human capital, namely in the obtainment of tertiary degrees. Against this background, we then compared trends in educational homogamy, finding evidence of a strong and persistent association between the educational credentials of couples in both Germany and Switzerland.

Our results demonstrate evidence of slightly higher inter-couple income inequality for educational homogenous couples than if they were randomly matched. Although this difference is small, a consistent trend across cohorts for individuals born after 1950 emerges, which indicates that these trends are occurring in relation to educational expansion and particularly the increase of female human capital. While not the focus of this contribution, this observation might reflect differences in female labor supply in relation to partners' earnings. This view is then also in line with the finding that significant differences between observed inter-couple income inequality and the one under a random choice of partners are mostly mediated by endogenous labor supply decisions within households. As discussed in the interpretation of results, however, differences observed across cohorts may reflect

different life course stages. Although we are not able to disentangle cohort and age effects, we have argued that only slight changes in levels are evident across cohorts, whereas the overall patterns remain quite similar. Moreover, we only find strong differences amongst the oldest and youngest cohorts. Thus, we do not expect age effects to strongly bias our findings.

Together, our analyses indicate that educational homogamy only partially contributes to the rise in income inequality in recent years. Hence, the potential socio-economic consequences of these demographic trends are marginal in comparison to other trends, such as the increase in single households. Nevertheless, our paper contributes to the current literature on educational expansion, especially with regards to its consequences for socio-economic and gender equality. By comparatively analyzing socio-demographic and socio-economic consequences of educational expansion, we demonstrate that both aspects are intricately linked and can potentially contribute to overall household material well-being and differences between households. However, the extent of impact is directly relational to (female) labor supply, which is in line with many of the previous studies on dual earner countries (Breen and Salazar 2011; Schwartz 2010; Cancian and Reed 1999; Breen and Salazar 2010; Breen and Andersen 2012; Dribe and Nystedt 2013). While labor supply is undoubtedly a crucial factor, alternative explanations may better explain why educational homogamy has not contributed to increased income inequality in either dual earner or male breadwinner countries.

Moreover, differences in couples' earnings may also reflect gender differences regarding pay, although for our purposes, this difference is accounted for once we included Heckman-imputed hourly wage rate for the measurement of our dependent variable. In both settings, the gender pay gap is equally likely to influence the impact of educational homogamy on inter-couple income inequality as female labor supply. We therefore argue that gender differences in work time and pay are consequentially related to inter-couple income inequality. Thus, future work relating socio-economic to socio-demographic consequences of educational expansion should look more closely into differences in female labor supply and educational returns to further examine a potential tradeoff between gender and income inequalities.

6 References

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7 Appendix

Appendix 1 Variable operationalization

Variable	Description
Income/Earnings	
Log gross yearly household income	Household level variable; Includes individual earnings of the household members as well as additional sources of income.
Log gross yearly earnings from labor market participation	Individual level variable; Based on current labor market participation; The dependent variable in the Heckman selection model.
Log gross hourly wage rate	Estimated hourly wage rates (for all obs. in all years) based on a heckman selection model (See the document describing necessary methodological steps.
Log gross yearly earnings	Based on the estimated log hourly wage rate (hatlnhwage / hatlnhwage_p): hours * hatlnhwage * 4.33 * 12

Continuation of Appendix 1 on the next page.

Continuation of Appendix 1.

Variable	Description
Demographics	
Gender	1 = Female
Age	Based on birth year and survey year
Education	Based on ISCED: General Schooling Vocational Education and Training Higher Education
Number of children in household (by age group)	Kids1: Children aged 4 years and younger. Kids2: Children aged 5 to 14 Kids3: Children aged 15 to 18
Migration background	Based on information about country of birth, citizenship at birth, parents' citizenship Born in residing country, one parent of that origin Born in residing country, no parent of that origin Not born in residing country
Labor market	
Employment status	Employed Unemployed Not employed
Tenure	Total years in employment
Working hours per week	Based on information about the hours worked in all or first and second job: 0 hours / not in employment 1–10 hours 11–20 hours 21–30 hours 31–40 hours 41–50 hours 51–80 hours
Time	
Survey Year	Year survey data was taken
Birth Cohort	1935–1940 1941–1945 1946–1950 1951–1955 1956–1960 1961–1965 1966–1970 1971–1975 1976–1980 1981 and younger

Appendix 2 Summary description of SHP variables

Variable	Obs.	Mean	Min.	Max.
Income/Earnings				
Gross yearly household income	24 648	84 316	1 160	2 068 270
Gross yearly earnings from labor market participation (observed)	24 648	175 327	0	697 533
Log gross hourly wage rate	24 648	3.71	0.81	6.26
Gross yearly earnings (simulated with labor supply)	24 648	177 737	0	1 303 059
Demographics				
Gender	24 648	0.50	0	1
Age	24 648	44.54	25	64
Education	24 648	2.39	1	3
Number of children in household (under 4 years of age)	24 648	0.23	0	3
Number of children in household (5–14 years of age)	24 648	0.65	0	6
Number of children in household (15–18 years of age)	24 648	0.25	0	5
Migration background	24 648	1.34	1	3
Labor market				
Employment status	24 648	1.16	1	3
Tenure	24 648	22.54	0	61
Working hours per week (observed)	24 648	3.70	0	6
Time				
Survey Year	24 648	2005	1999	2013
Birth Cohort	24 648	4.82	1	9

Source: Swiss Household Panel (w15), 1999–2013.

Appendix 3 Summary description of SOEP variables

Variable	Obs.	Mean	Min.	Max.
Income/Earnings				
Gross yearly household income	134 720	53 681	0	3 564 784
Gross yearly earnings from labor market participation (observed)	134 720	59 388	0	422 208
Log gross hourly wage rate	134 720	2.71	–1.80	5.99
Gross yearly earnings (simulated with labor supply)	134 720	54 703	0	904 363
Demographics				
Gender	134 720	0.50	0	1
Age	134 720	45.62	25	64
Education	134 720	2.22	1	3
Number of children in household (under 4 years of age)	134 720	0.16	0	3
Number of children in household (5–14 years of age)	134 720	0.48	0	6
Number of children in household (15–18 years of age)	134 720	0.21	0	4
Migration background	134 720	1.24	1	3
Labor market				
Employment status	134 720	1.38	1	3
Tenure	134 720	20.60	0	72.5
Working hours per week (observed)	134 720	3.25	0	6
Time				
Survey year	134 720	2005	1999	2013
Birth cohort	134 720	4.41	1	9

Source: German Socio Economic Panel (w30), 1999–2013.

Continuation of Appendix 4 on the next page.

Appendix 4 Female participation in education and the labor market (Switzerland and Germany)

	Cohort								
	<1946	1946–50	1951–55	1956–60	1961–65	1966–70	1971–75	1976–80	1981+
Highest Education (Switzerland)									
General Education	0.09	0.08	0.05	0.07	0.04	0.06	0.04	0.03	0.02
Vocational Education and Training	0.76	0.72	0.70	0.66	0.66	0.59	0.60	0.60	0.46
Higher Education	0.15	0.19	0.25	0.27	0.30	0.35	0.37	0.36	0.53
N	369	769	1523	1975	2582	2280	1583	809	438
Labor Market Participation (Switzerland)									
Employed	0.67	0.81	0.81	0.84	0.85	0.88	0.92	0.93	0.98
Unemployed	0.03	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
Not Employed	0.31	0.19	0.19	0.15	0.14	0.11	0.08	0.06	0.02
N	369	769	1523	1975	2582	2280	1583	809	438
Highest Education (Germany)									
General Education	0.23	0.18	0.13	0.12	0.10	0.13	0.13	0.09	0.10
Vocational Education and Training	0.56	0.58	0.54	0.56	0.61	0.59	0.57	0.64	0.61
Higher Education	0.21	0.24	0.33	0.32	0.29	0.28	0.30	0.27	0.28
N	4731	6364	9510	11197	11798	10871	7084	4018	1850
Labor Market Participation (Germany)									
Employed	0.37	0.60	0.76	0.79	0.78	0.74	0.69	0.70	0.93
Unemployed	0.11	0.08	0.06	0.05	0.05	0.05	0.05	0.05	0.00
Not Employed	0.52	0.32	0.18	0.16	0.17	0.21	0.26	0.25	0.07
N	4731	6364	9510	11197	11798	10871	7084	4018	1850